National Park Service Inventory and Monitoring Program

Coastal and Barrier Network Vital Signs Process

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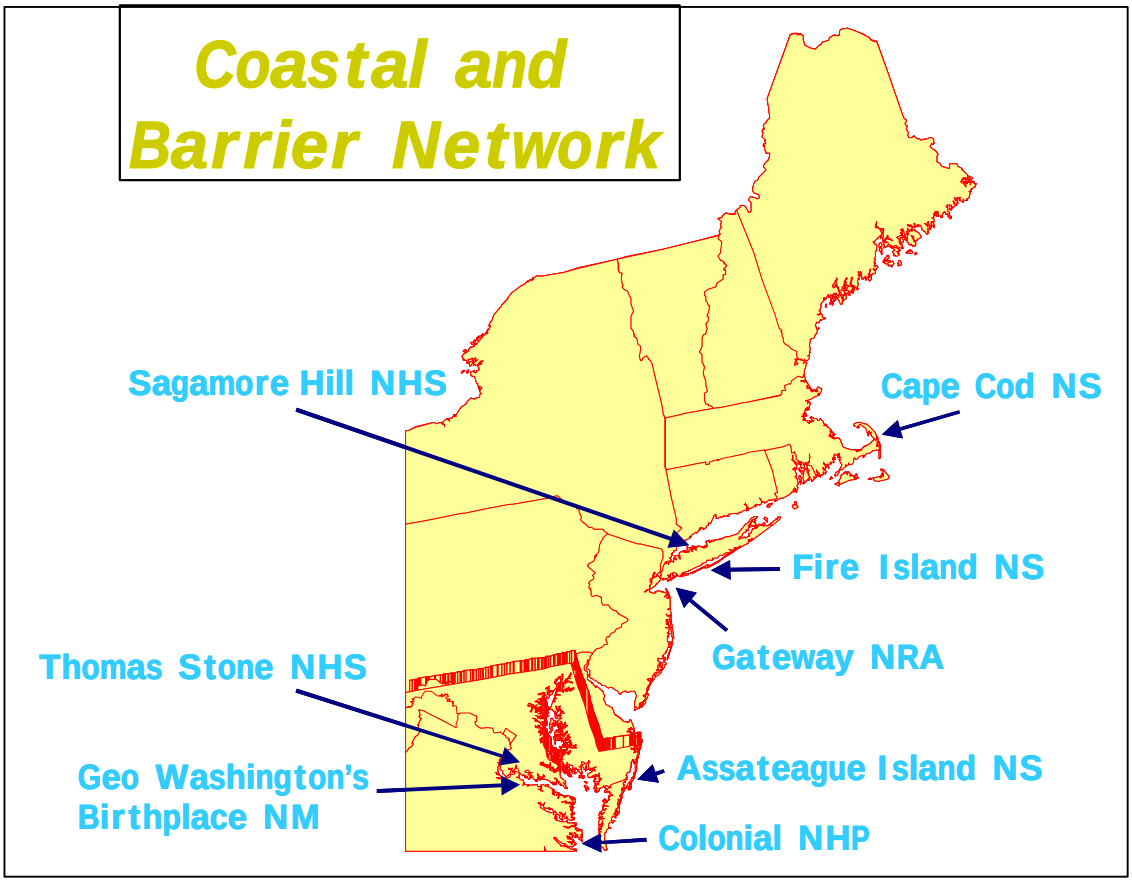

Introduction

The task of developing a long-term monitoring program to detect and recognize significant change is complex. Natural systems are inherently dynamic and spatially heterogeneous. Further, many changes in space and time are not a consequence of human-induced actions, and many are not amenable to management intervention. In general, monitoring data are intended to detect long-term environmental change, provide insights to the ecological consequences of these changes, and to help decision makers determine if the observed changes dictate a correction to management practices (Noon et al, 1999). A monitoring program should address not only today's resource problems, but also the need for information to anticipate and define future resource problems. Therefore, ecosystem monitoring is conducted primarily for two purposes: (1) to detect significant changes in resource abundance, condition, population structure, or ecological processes; or (2) to determine the effects of some management action on population or community dynamics or ecological processes.

Knowing the condition of natural resources in the National Park system is fundamental to the Services ability to protect and manage the parks. Based on legal mandates and National Park Service policy, and the need for better natural resource management in the parks, the major goals of the Servicewide I&M Program are to:

1. establish natural resource inventory and monitoring as a standard practice throughout the National Park system which transcends traditional program, activity, and funding boundaries;

2. inventory the natural resources and park ecosystems under National Park Service stewardship to determine their nature and status;

3. monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments;

4. integrate natural resource inventory and monitoring information into National Park Service planning, management, and decision making and;

5. share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

(These five long-term programmatic goals are discussed in more detail at: http://www.nature.nps.gov/im/monitor/nps75.pdf)

The first step in developing a long-term monitoring program is to articulate clearly the management goals and objectives of the park-specific program in concert with regional and Servicewide goals and objectives. The overall goal of natural resource monitoring in parks is to develop scientifically sound information on the current status and long term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems. In order to be effective, monitoring objectives should be realistic, specific, unambiguous, and measurable and include the following six components to be complete (Elzinga et al. 1998):

1. the indicator to be monitored
2. the location or geographical area
3. the attribute of the indicator to be measured (e.g., population size, density, percent cover)
4. the intended management action (increase, decrease, maintain)
5. the measurable state or degree of change for the attribute
6. the time frame

The following criteria are critical to the design of a successful monitoring program:

- Using the same methods or protocols to take measurements over time.
- Designing the monitoring program for a specific purpose, usually to determine progress toward a management objective.
- And taking some action based on the results, even if the action is to maintain the current management.

To meet these criteria, the NPS I&M Monitoring Program must:

- be relevant to current management issues as well as anticipate future issues based on current and potential threats to park resources;
- be scientifically credible;

- produce data of known quality that is accessible to managers and researchers and provided in a timely manner;
- have an explicit link to management decision-making.

Network Description

As part of the NPS Inventory and Monitoring Program, the Coastal and Barrier Network contains eight National Park Service sites in five states, extending from the Cape Cod National Seashore in Massachusetts to the Colonial National Historical Park in Virginia (Table 1). These parks represent some of the most ecologically similar collections of lands within the Park Service. They consist of critical coastal habitat for many rare and endangered species, as well as migratory corridors for birds, sea turtles and marine mammals. They also protect vital coastal wetlands, essential to water quality, fisheries, and the biological diversity of coastal, nearshore, and terrestrial environments. Key components in developing a structured monitoring program for the network include data collection, information management, preparation of data summaries and interpretive reports, feedback to management, and program coordination and support.

Table 1. Park Members of the Coastal and Barrier Network.

Park Name	Code	Location	Hectares	Acreage
Assateague Island National Seashore	ASIS	MD,VA	19,200	48,000
Cape Cod National Seashore	CACO	MA	17,442	43,604
Gateway National Recreation Area	GATE	NY, NJ	10,644	26,610
Fire Island National Seashore	FIIS	NY	7,832	19,580
Colonial National Historical Park	COLO	VA	3,740	9,350
George Washington's Birth Place National Monument	GEWA	VA	220	550
Thomas Stone National Historic Site	THST	MD	129	322
Sagamore Hill National Historic Site	SAHI	NY	33	83

Developing a Monitoring Program for the Coastal and Barrier Network

In 1996, CACO, one of the Northeast Coastal and Barrier Network parks, was identified as a prototype park for long-term ecological monitoring within the Atlantic and Gulf Coast biogeographic region. As a prototype park and in partnership with U.S. Geological Survey (USGS), CACO was charged with developing and refining long-term monitoring protocols that could be of utility to other Atlantic and Gulf Coast parks, in addition to supporting management of Cape Cod's natural resources. With the advent of the network approach to inventory and monitoring, the park's mission expanded to include focused technical support to the Northeast and Coastal Barrier Network. Specifically, the park's role as a prototype park is to:

- test inventory and monitoring methods specific to the northeast coastal eco-region;
- develop long-term monitoring protocols relevant to CACO and to systems common among parks in the Network - many of these protocols will also be of use to parks in the broader biogeographic region;
- conduct studies that will help identify "vital sign" parameters for the Network and that refine, develop, or interpret the results of ecological monitoring; and
- provide technical expertise regarding inventory and monitoring techniques to the Network and parks in the broader biogeographic region.

Development of the CACO long-term ecological monitoring program has been a collaborative effort primarily between USGS and NPS. Although USGS provided the bulk of the funding for development of a conceptual framework for the CACO program and for protocol development, the park began receiving funding specifically for the long-term monitoring program in 1997. In 1999 the Conceptual Framework for the Development of Long-term Monitoring Protocols at Cape Code National Seashore, by Charles Roman and Nels Barrett was published (http://www.nature.nps.gov/im/monitor/caco.pdf). The overall goal of the Long-term Coastal Ecosystem Monitoring Program (LTEM) at Cape Cod National Seashore is:

- to detect changes in particular attributes of the coastal ecosystem and determine if those changes are within the bounds of natural or historic variability;
- to predict how those changes relate to natural processes and human-influences; and,
- to understand how such changes, ultimately, affect the condition of the coastal ecosystem.

It is important to the note that the term change is applied broadly to express trends (value differences) in several measures including: the rates of change (e.g., annual, decadal, or centurial time scales), the extent of change (e.g., site-specific versus regional/global spatial scales), and the intensity of change (e.g., magnitude of the effect).

Generally, the aim of the LTEM program at Cape Cod National Seashore is: (1) to validate model assumptions and predictions that explain how (and why) changes occur; (2) to forecast potentially adverse changes that provide "early warning" capabilities; (3) to inform whether and when management intervention is necessary; and (4) to evaluate the effectiveness of management, i.e., how well an ecosystem is being sustained in accordance with current management practices and regulatory compliance (National Research Council 1990, Spellerberg 1991).

Most importantly, the information generated from the monitoring program is intended to assist the park manager in clarifying and addressing issues as part of the decision-making process. Do the observed changes represent current problems or forecast emerging problems that might adversely affect the ecological integrity of the coastal ecosystem? Do the problems require immediate action? Can the problems be remedied by management actions? Understanding the dynamic nature of coastal ecosystems and the consequences of human activity is essential for management decision-making aimed to maintain, enhance, or restore the ecological integrity of the coastal ecosystem and to avoid, minimize, or mitigate ecological threats to the coastal ecosystem.

In order to provide structure and basis to a monitoring program that could encompass all eight parks within the Coastal and Barrier Network, the Network's technical steering committee chose to accept the goals and objectives of the CACO long-term coastal ecosystem monitoring program.

In 1999, under the direction of the Regional Inventory and Monitoring Coordinator, the Coastal and Barrier Network began to address the seven-step plan to developing a network monitoring program recommended by the National Monitoring Program (http://www.nature.nps.gov/im/monitor/approach.htm):

1. Form a steering committee. (and board of directors)
2. Summarize existing data and understanding.
3. Prepare for and hold a scoping workshop.
4. Write a report on the workshop and having it widely reviewed.

5. Hold a meeting to decide on priorities and implementing approaches.
6. Draft the monitoring strategy.
7. Review and approval of the monitoring strategy.

Step 1 - The Steering Committee and Board of Directors

In early 2000 a Coastal and Barrier Network steering committee was established. Members of the steering committee were nominated by park staff, the regional I&M coordinator and regional chief scientists. Those selected were either scientists familiar with the parks or who had done research pertaining to coastal ecosystem monitoring, or both.

The steering committee advises and assists in decision making on issues regarding the development and implementation of a coastal park monitoring strategy, hiring both permanent and temporary staff, budgeting, scheduling, and promoting accountability for the program. In March 2000, the committee met for the first time. The members were asked to help develop a Vital Signs Scoping workshop, including the agenda, identifying and prioritizing management issues, identifying representative ecosystems existing within the network parks and developing monitoring questions.

The network is also managed by a Board of Directors that includes the seven superintendents (THST and GEWA share a superintendent), the two chief scientists for the region, the regional inventory and monitoring coordinator and the network inventory and monitoring coordinator. The board works closely with the Network Data Manager and the Technical Steering Committee to insure monitoring goals are met. There is at least one board meeting a year. The major responsibilities of the Board are to:

- require accountability and effectiveness for the I&M Program by reviewing progress, quality control, and spending of Network funds;
- provide guidance to the Network Coordinator, Network Data Manager, Technical Steering Committee (See subgroups section) and natural resource staffs of the Network's parks in the purpose, design and implementation of vital signs monitoring and other management activities related to the Natural Resource Challenge;

- decide on strategies and procedures for leveraging Network funds and personnel to best accomplish inventory and monitoring and other natural resource needs of Network parks;
- consult on hiring Network personnel using funding provided to the Network, including base funds and other sources;
- seek additional financial support to leverage the Servicewide funds; and
- solicit professional guidance from and partnerships with other governmental agencies, organizations and individuals.

Step 2 - Summarizing existing data and understanding for the Network

Summarizing the existing data for the Network has been an ongoing process. Much of the time spent so far has been to compile inventory data on vertebrates and vascular plants and entering this information into the three main I&M databases, NPSpecies, NatureBib and the Dataset Catalog. More recently, after the April 2000 Network Vital Signs Scoping Workshop, a number of proposals were funded to begin compiling information specific to monitoring questions developed during the scoping workshop. The following scopes of work were developed and are either complete or underway:

1. Gathering existing Shoreline Change data for each of the Network parks.

    - Mark Duffy, the GIS coordinator from Assateague (ASIS) was detailed to the Network for Shoreline Change program data mining, data development, and needs assessment and protocol development. The Network provided funds to backfill at ASIS and supports the GIS program in exchange for 75% of Mark's time and 25% of the backfill time. A written agreement was developed and signed by the Regional Coordinator and ASIS Superintendent.

2. Development and use of existing LIDAR data.

    - An interagency agreement with USGS Center for Coastal Studies in St. Petersburg, Florida was developed for a project titled, "Creation of Aerial Mapping Data Products for Park Vital Signs Monitoring within the Northeast Coastal and Barrier Network". The cooperator will process LIDAR data on existing NASA flights most of which are for ASIS. The Network will use these products to illustrate the utility of these data for monitoring.

3. Identifying species monitoring programs existing in or around each park.

    - A research associate with University of RI has compiled information on existing monitoring programs on rare threatened and endangered species and habitats, and keystone species in (or near) the Network parks. The research associate has identified existing and potential threats to species and habitats, described current monitoring programs and their data, identified other monitoring outside of the parks and reviewed literature on

keystone species monitoring along the North Atlantic coast. She has written a draft report summarizing all of this information. A panel of experts will be convened to guide the development of a species and habitats monitoring program based on information gather by the URI cooperative agreement. A detailed scope of work was developed and an access database is being used to compile information. Inventory data has been found as well.

4. Identification of freshwater wetland types and threats to those wetlands in the Network parks.

   - A cooperative agreement was established with the University of RI (James-Pirri and Roman) to complete a scoping report that summarizes threats, establishes how those threats are altering the structure and function of wetlands in the Network's parks. In addition, existing freshwater quality monitoring programs will be evaluated and improvements suggested if appropriate. Information from state 305(b) and 303(d) reports will be summarized and discussed in light of our need to identify pristine waters and impaired waters in the network.

Steps 3&4-Holding a Network Scoping Workshop and writing a workshop report

In April 2000, the first Network Vital Signs Scoping Workshop was held. Based on the CACO "prototype" monitoring program, the steering committee chose to discuss the four ecosystems as a basis for discussion of Network-wide monitoring issues for the scoping workshop. For each of these ecosystem types detailed Conceptual models had been developed as part of CACO's monitoring program that included: agents of change, stressors and ecosystem responses. The four ecosystems include:

1. Estuaries and near shore environment
2. Freshwater wetlands, pond and streams
3. Uplands (forests, grasslands and thickets)
4. Beaches, dunes, spits and shoreline systems

Based upon prior input from the parks, the steering committee then selected high priority management issues relevant to all the Coastal and Barrier parks:

- Shoreline Change
- Water Quality
- Species and Habitats of Concern
- Resource Extraction
- Recreation and Visitor Use

The steering committee then proposed monitoring questions and identified candidate indicators or "Vital Signs" for each management issue based largely on the Cape Cod National Seashore prototype (Appendix-Document I). Vital signs are indicators of the key ecological processes, which, collectively, capture the function of a healthy ecosystem. They represent early warning signs of ecosystem stress, ideally before significant damage has occurred, and point to the need for intensive studies to diagnose the cause of the stress and determine appropriate corrective action. They may include keystone species and keystone habitats, which have profound effects on ecosystem organization and function; dominant species; or key processes such as nutrient cycling, shoreline dynamics, or hydrologic regimes. Aquatic species populations, nutrient and contaminant input, and water table level are just a few examples of "vital signs", broadly applicable and relevant to most Coastal and Barrier Network Parks (Table 2).

Table 2. Characteristics of the ideal "Vital Sign".

• have ***dynamics*** that parallel those of the ecosystem or component of interest; • are ***anticipatory***: they signal degradation before serious harm has occurred; • are ***sensitive enough*** (or broadly applicable to many stressors) to provide an early warning of change; • have a ***high "signal to noise",*** are relatively insensitive to factors other than the stressor; • provide a ***continuous assessment*** over a wide range of impacts; • have ***dynamics*** that are easily	• are at an appropriate ***scale***; • are ***constant*** during the period of measurement; • are ***easy to measure***, ***time*** and ***cost effective*** and ***standard protocols*** are available; • are ***related*** to ecosystem condition in a way that can be ***interpreted*** and ***explained***, there is a clear ***connection*** between the indicator and the function it reflects; • are ***low impact*** or ***non-destructive*** to measure and; • have ***measurable results*** that are repeatable/consistent with

attributed to either natural cycles OR anthropogenic sources; • are ***distributed*** over a wide geographical area and/or are very numerous; • can be **accurately** and ***precisely estimated***; • have ***low natural* variability**; • have ***known variability*** and other statistical properties so criteria for being "out of range" are known;	different observers; • are ***timely*** and provide information quickly enough to react; • are ***unique*** and ***do not duplicate*** other indicators; • can be ***communicated*** to managers and the public; • are ***socially* relevant** and ***politically appealing***: people care about the indicator.

Workshop Preparation

Park Contributions to the Workshop

Prior to the workshop, each resource manager was asked to provide a description of their park and resources as well as provide the following:

1. A list of species and habitats of concern.
2. A list of species/resources extracted from the park by hunting, fishing, poaching, groundwater removal, sand, crops, etc…and the habitats impacted by removal.
3. A list of fully operational, ongoing monitoring programs.
4. A list of additional management issues not included in the list created by the steering committee.

Workshop Participants

Workshop participants were selected based on knowledge of park resources and issues in the Coastal and Barrier Network and/or scientific expertise relevant to selected ecosystems. Some of those who were invited to the workshop, but were unable to attend agreed to review the workshop report. Prior to the scoping workshop, prospective participants were sent a briefing packet of reading material to 1) explain the purpose of the NPS I&M Program and the scoping workshop and 2) provide a conceptual background for planning a monitoring strategy (Appendix-Document II).

Table 3. Coastal and Barrier Network I&M Workshop: Monitoring Briefing Materials.

- Vital Signs Workshop Agenda and description of workshop format, as well as product examples to be created during the workshop.
- A list of management issues in coastal and barrier parks.
- A summary of a workshop held by the Patuxent Wildlife Research Center on coastal issues.
- Description of Coastal and Barrier Network Parks resources and settings, including responses to questions listed above.
- Conceptual framework for the development of long-term monitoring protocols at Cape Cod National Seashore.
- GIS layers available for each park.

Workgroups

During the scoping workshop, participants were divided into five workgroups based on the five management issues identified by the steering committee; shoreline change, water quality, species and habitats of concern, resource extraction and recreation and visitor use. Each group was directed by a leader, who guided the group through discussion and completion of the vital signs templates for each indicator addressed, and the completion of the workgroup summary sheet

Following the scoping workshop, the workgroups were asked to write a report on the results of their workgroup discussions and send it to the I&M Coordinator to be included in the Northeast Coastal and Barrier Network Scoping Workshop Report. The following is a summary of what was discussed and identified for monitoring by the five workgroups.

Water Quality

This workgroup created a list of what they considered the most significant threats to water quality in the Coastal and Barrier Network (Tables 4 & 5). They suggest that a monitoring program's minimum capabilities be to detect a change in park ecosystems relative to these threats. The group also developed three broad monitoring questions during the workshop (listed below). Candidate vital signs with potential for providing answers to these monitoring questions were then identified (summarized in Table 4).

1. Is water quality changing outside the bounds of natural variability?

2. Does changing water quality impact natural and cultural resources and visitor use?

3. What are the causes of changes in water quality?

The group then addressed and prioritized vital signs for these monitoring questions as well as measurement parameters. (Table 5).

Table 4. Water quality stressors identified by the workgroup.

Threats/Stressors	**Categories of Candidate Vital Signs**
Eutrophication (including harmful algae blooms)	▪ Autotrophic production ▪ Community composition/distribution ▪ Ecosystem metabolism ▪ Nutrient load ▪ Watershed characteristics ▪ Nutrient Sources
Contaminants (including toxics, bacterial contamination, marine debris, and sediments)	▪ Contaminant concentration change ▪ Light attenuation change ▪ Acute or chronic responses in aquatic flora and fauna communities. ▪ Sources of contaminant input ▪ Physical processes influencing bioavailability of contaminants
Hydrologic Alterations (including tidal restriction, groundwater withdrawal, saltwater intrusion)	▪ Surface and groundwater level ▪ Water chemistry ▪ Community composition, distribution, and production ▪ Ecosystem metabolism
Acidification	▪ pH and water chemistry ▪ Acid Neutralizing Capacity ▪ Ecosystem metabolism ▪ Responses by terrestrial vegetation and cultural resources

Table 5. The top ranked water quality vital signs identified by the Water Quality Workgroup.

Ranked Vital Signs	Resource	Measurement Parameters	Sampling Frequency
1. Basic Water Quality	Estuaries Nearshore environments Freshwater wetlands Ponds Streams	Temperature Salinity (salt water) Electrical conductivity (freshwater) Dissolved oxygen (to include diel depth profiling as needed to determine the depth and duration of hypoxia/anoxia) Total Nitrogen, Phosphorus pH Acid Neutralizing Capacity Depth Turbidity/% light transmission Total water column chlorophyll a Total suspended solids Fecal-Indicator Bacteria	Monthly or less with additional event sampling
2. Land Use/Land Cover/Vegetation Mapping	Estuaries Nearshore environments Freshwater wetlands Ponds Streams	Watersheds within and outside park boundaries Distribution of major vegetation types (including submerged aquatic vegetation and potentially macroalgae)	Aerial photographs acquired and interpreted, with ground truthing, every 2-5 years.
3. Fauna	Estuaries Nearshore environments Freshwater wetlands Ponds Streams	Species richness Distribution and abundance of macroinvertebrates in saltwater environments (The value of fish should be reviewed as a potential faunal indicator instead of or in addition to macroinverts)	

4. Surface and groundwater levels	Estuaries Nearshore environments Freshwater wetlands Ponds Streams Uplands Beaches Dunes Spits Shoreline systems	Distribution and connectedness of surface waters (including seasonal and tidal components of surface water cover and depth) Precipitation (quantity) Groundwater chemistry (annually)	

Table 5 (Continued).

Ranked Vital Signs	Resource	Measurement Parameters	Sampling Frequency
5. Water Column-Sediment Toxicity	Estuaries Nearshore environments Freshwater wetlands Ponds Streams Uplands Beaches Dunes Spits Shoreline systems	Bioassays using macroinvertebrates Tissue residues in fish and shellfish Sediment chemistry	
6. Amphibian distr. and abundance	freshwater wetlands, ponds and streams		

<u>Shoreline Change</u> ("Shore Zone" Change)

Development of monitoring questions requires the identification of key management issues within the network. The shoreline change workgroup collectively agreed that one of the fundamental problems facing resource managers in coastal or barrier parks is the spatial patterns of loss or gain of land due to shoreline change. Coastal parks such as Assateague Island, Fire Island and Gateway need to monitor
shoreline changes to better understand and predict the effects of this fundamental attribute. The Chesapeake Bay parks such as COLO and GEWA have similar land loss issues. Shoreline changes, resulting from a combination of natural coastal processes and processes altered by human manipulation of shorelines or sediment supplies, can have profound effects on natural resources, habitats and the built and historic environment, both cultural and archaeological resources and

visitor facilities. For example, the process of shoreline change directly affects dune and vegetation patterns, which in turn, determine the availability of critical habitat for threatened species such as the piping plover and seabeach amaranth. Better information on shoreline change also reduces the long-term costs of facility management by identifying those areas least suitable for development. Protection of cultural resources depends on knowledge of shoreline change. A general monitoring question pertaining to shoreline change was developed by the workgroup as well as three basic vital signs or indicators of change (Table 6).

The workgroup then made recommendations for the design and implementation of a Monitoring Program for Shoreline Change. Their recommendations are as follows:

1. The three methods suggested for implementation of a monitoring program are available at all space and time scales deemed necessary and affordable.
2. The NPS should be careful not to duplicate efforts to train staff and purchase equipment.
3. A coordinator should be hired by the NPS I&M Program to lead the monitoring effort. Requirements for this person should include:
    - Skilled in data gathering and analysis
    - Required to support all coastal parks when and where needed
    - Required to oversee park staff's field surveys fulfillments
    - Stationed regionally, but University based in order to make use of new advances in technology and methodology

Table 6. Spatial and temporal coastal change monitoring questions, vital signs and methods.

Monitoring Question: What is the spatial and temporal variation of the frequencies and magnitudes of coastal change?		
Vital signs/indicators	**Methods**	**Measurements**
▪ Shoreline position ▪ Temporal variability (mean high water) ▪ Spatial variability ("fetch-limited" shorelines)	▪ Aerial imagery ▪ GIS oriented data ▪ 2-D or 3-D Field surveys	▪ Profile transects
▪ Landward limit of shore zone change	▪ Aerial imagery ▪ GIS oriented data ▪ 2-D or 3-D Field surveys	

▪ Elevational change data characteristics of the coastal topographic envelope of concern	▪ Airborne topographic mapping	▪ Rate of loss of uplands

Recreation and Visitor Use

The key management issue identified by this workgroup as affecting all Coastal and Barrier Network parks was the threat of increased visitor use and recreational activities on the quality of park resources and visitor experiences.

The workgroup then developed two monitoring questions based on this management issue as well as indicators and methods of indicator measurement (Table 7).

- How are the type, amount, and distribution of visitor uses changing over time?

- What type and extent of resource degradation is occurring?

Table 7. Recreation and visitor use monitoring questions, vital signs and methods.

Monitoring Question: How are the type, amount, and distribution of visitor uses changing over time?		
	Vital Signs	**Methods**
Measure of visitor use	▪ Type of recreation use ▪ Amount of recreation use ▪ Distribution of recreation use	▪ Management workshop to ID and map ▪ Direct observation from selected sample points ▪ Park use assessment methods (entry point questions/counts, parking lot counts) ▪ Aerial surveys for selected use types (e.g. boats, ORV's)

Monitoring Question: What type and extent of resource degradation is occurring?		
	Vital Signs	**Methods**
Effects on Vegetation	▪ Vegetation loss ▪ Vegetation compositional change ▪ Unintended trail proliferation ▪ Unintended recreation site proliferation ▪ Substrate erosion	▪ Aerial photography ▪ Vegetation sampling along trails and recreation sites
Effects on wildlife	▪ Disturbance time ▪ Road kills ▪ Attraction behavior	▪ Direct observation ▪ Road segment sampling ▪ Observation of visitor WL feeding ▪ Observation of WL attraction ▪ behavior
Effects on water resources	▪ Water turbidity ▪ Biological contamination	▪ Sampling at recreation sites and paired controls

Species and Habitats of Concern

This workgroup focused specifically on non-native and invasive species, rare, threatened and endangered species, and habitats and communities of special significance (Table 8).

Table 8. Species and Habitats of Concern-- monitoring questions, vital signs and methods.

Monitoring Question	Vital Signs	Measurements/Methods
What are the changing trends of exotic and invasive species?	▪ Distribution of invasive species ▪ Change in abundance of exotic species ▪ Abund. of epiphytic algae in eelgrass beds	▪ Mapping intervals ▪ Permanent plots establish and revisit
What factors are contributing to exotic species expansion?	▪ Adjacent land use rate of change ▪ Human use patterns/change ▪ Soil disturbance	▪ % forest cover ▪ Density of homes ▪ Miles of road ▪ Land use classification
What are the effects of exotic/invasive species on Park resources?	▪ Trend of Exotics ▪ Featured species (e.g., deer, ponies) ▪ Distribution of other species ▪ Reproduction of other species	▪ Frequency ▪ Abundance ▪ Distribution ▪ Demographics
What are the changing trends of rare species?	▪ Population status ▪ Abundance and distribution of rare species ▪ Community status	▪ Distribution ▪ Abundance ▪ Recovery Plan Goals (metrics)
What are the changes in species composition & diversity in major habitats?	▪ Vegetation ▪ Native freshwater fish ▪ Amphibians ▪ Migratory bird ▪ Small mammals ▪ Changes in Park resource composition	▪ population turnover ▪ reproductive success ▪ species richness/diversity ▪ predation rates ▪ nesting trends ▪ distribution and abundance
What are the changes in spatial	▪ Abundance and distribution of community types	▪ Mapping

distribution and abundance of major vegetation communities?		

Monitoring questions developed by the workgroup included:

- What are the changing trends of exotic and invasive species (frequency, abundance, and distribution)?
- What factors are contributing to exotic species?
- What are the effects of exotic/invasive species on Park resources?
- What are the changing trends in rare species (frequency, abundance, and distribution)?
- What are the changes in species [diversity] composition of major habitats?
- What are the changes in spatial distribution and abundance of major vegetation communities (mapping) i.e., communities of concern?
- What are the changing trends in featured species (deer, horses)?
- What is the rate of change in adjacent land use?

Resource Extraction

Resource extraction involves species and activities that are seasonal or transient in the parks. It involves shell fishing, fishing, hunting, poaching, groundwater withdrawal, collecting, harvesting, dredging, etc… Eight Resource Extraction issues were identified by the workgroup:

1. Finfishing (all parks)
2. Shellfishing (all parks)
3. Groundwater Extraction for Potable Water and Irrigation (CACO)
4. Sand Mining (ASIS)
5. Channel Dredging (GATE)
6. Hunting (most parks)
7. Recreational Collecting-mushrooms, shells, butterflies, herps, etc. (not identified as a major issue in any of the Network parks)
8. Surface Water Extraction (COLO)

From this list a "stressor/response table" was created (Table 9).

Table 9. Stressors/Responses identified by the Resource Extraction workgroup.

Threat	**Stressor**	**Response**
Shellfish Extraction (commercial and recreational)	Bottom disturbance	Decline in biodiversity Degraded water quality Recreation impact
Finfish Extraction	Loss of predation	Decline in biodiversity Degraded water quality Recreational impact
Hunting/Collecting	Decline in species #'s (mushrooms, butterflies, deer, plants)	Impact on decomposition Impact on pollination Decline in biodiversity
Groundwater Extraction	Change in water table Nutrient loading Increased salinity in groundwater	Increased salinity Change in plant/animal species Increased contaminant delivery to system
Sand Extraction	Change in littoral drift Change in shoreline dynamics	Change in shoreline (beach retreat) Change in shoreline bathymetry
Muck Extraction (Dredging)	Resuspension of contaminated sediment. Change in hydrography and sediment suspension budget	Erosion Contaminant redistribution Change in light penetration Change in benthic diversity

The workgroup decided upon and prioritized what they felt were the top three monitoring questions based upon the impacts Resource Extraction has on park resources. They then identified a vital sign for each of the three monitoring questions as well as identified ecosystems affected and justification for why the vital sign was chosen.

Monitoring Question #1:
What are the effects of groundwater extraction on water tables (very significant), uplands, estuaries, wetlands and surface water availability?

Vital Sign:
Changes in water table and salinity that differ from natural patterns of variation.

Ecosystem this Vital Sign applies to: Freshwater Wetlands: ponds, streams,
Uplands: forest, grasslands, thickets

Justification for choosing this vital sign:

* Easy to measure
* In many cases has been measured for a long period of time and has known variability
* Measurement is nondestructive
* Can be communicated to managers and to the public

Monitoring Question#2:
How does coastal sand mining effect hydrography (residence time, wave climate, loss of shoals, sediment budget)? What is the frequency and intensity of sand dredging?

Vital Sign:
Bathymetry, shoreline change through GIS

Ecosystem this Vital Sign applies to: Beaches, dunes, spits, and shoreline systems

Justification for choosing this vital sign:

* Meets almost all the features of an ideal indicator.
* It is anticipatory and non-destructive to measure.

Monitoring Question#3:
What are the effects of commercial and recreational shellfish harvesting on park aquatic habitats?

Vital Sign:
Some measure of habitat disturbance to bottom habitat and associated communities (set up a control area (refuge) within the park for comparisons)

Ecosystem this Vital Sign applies to: Estuaries and Near Shore Environments

Justification for choosing this vital sign**:**

* The effect is monitorable
* Information can be used to justify a management action

Other information:

* Need to determine "threshold" values for disturbance
* Need inventory of state regulations describing allowable gear types

* Need to develop cause/effect relationship data describing disturbance per unit effort

Summary of Monitoring Questions Developed During the Workshop

Below is a complete list of monitoring questions developed during the workshop for the Coastal and Barrier Network

- Is water quality changing outside the bounds of natural variability?
- Does changing water quality impact natural and cultural resources and visitor use?
- What are the causes of water quality change?
- What is the spatial and temporal variation of the frequencies and magnitudes of coastal change?
- What are the changes in visitor use over time? (types, amounts, and distribution)
- What type and extent of resource degradation is occurring?
- What are the changing trends of exotic species (frequency, abundance, and distribution)?
- What factors contribute to the expansion of exotic and invasive species?
- What effects do exotics and invasives have on Park resources?
- What are the changing trends in rare species (frequency, abundance, and distribution)?
- What are the changes in species [diversity] composition of major habitats?
- What are the changes in spatial distribution and abundance of major vegetation communities (mapping) i.e., communities of concern?
- What are the changing trends in featured species?

- ♦ Adjacent land use - rate of change?

- ♦ What are the effects of groundwater extraction on water tables (very significant), uplands, estuaries, wetlands and surface water availability?
- ♦ How does coastal sand mining effect hydrography (residence time, wave climate, loss of shoals, sediment budget)? What is the frequency and intensity of sand dredging?

- ♦ What are the effects of commercial and recreational shellfish harvesting on park aquatic habitats?

Step 5 - Hold a meeting to decide on priorities and implementing approaches

In September 2000, the steering committee met for a second time. The agenda for this meeting was to discuss and follow up on the scoping workshop and to:

- review the scoping workshop report prior to sending it to participants;
- plan the next steps in developing a coastal vital signs monitoring program, and;
- develop a detailed list of network needs for 2001-2002 funding.

The steering committee agreed that the scoping workshop was successful in developing "laundry lists" of vital signs for the Network, but agreed that smaller workgroups were needed (no more than five people) to begin fine tuning the monitoring questions and lists of indicators developed during the workshop. The committee decided to put together small workgroups each, based upon the following issues:

- Shoreline Change
- Estuarine Water Quality (nutrients only)
- Freshwater Quality (nutrients only)
- Water Quality (Contaminants only)
- Visitor Use and Recreation
- Animal and Plant Species and Habitats of Special Concern
- Data management

These workgroups were asked to meet and produce a written product by February 15, 2001. Unfortunately, only four out the seven groups met and produced reports; shoreline change, estuarine water quality, freshwater quality and data management. From these groups, key scientists involved in the development of these reports

were asked to submit proposals to the Network to begin protocol development. The following proposals will be funded by the Network in FY02 and FY03:

- Testing Variables for Monitoring Estuarine Nutrient Enrichment within North Atlantic Parks, PI's: Hilary A. Neckles, USGS Patuxent Wildlife Research Center, Scott W. Nixon, University of Rhode Island Graduate School of Oceanography, and Blaine S. Kopp, USGS Patuxent Wildlife Research Center.

- National Park Service Coastal Visitor Impact Monitoring, PI's: Christopher Monz, Ph.D., Sterling College and Yu-Fai Leung, Ph.D., North Carolina State University.

- Environmental Contaminants Baseline Inventory and Monitoring for National Parks. PI's: Mark Robson, Rutgers University, and Keith Cooper, Ph.D., Cook College, Rutgers University.

- Implementing Long-Term Monitoring of Salt Marsh Communities within the Northeast Coastal and Barrier Network of the National Park Service, PI's: Mary-Jane James-Pirri, Graduate School of Oceanography, University of Rhode Island, Charles T. Roman, National Park Service.

- Aerial Data Collection and Creation of Products for Park Vital Signs Monitoring within Northeast Region Coastal and Barrier Network. PI's: John C. Brock, USGS Center for Coastal Studies and Mark Duffy, National Park Service

Things to consider

Vital Signs Scoping Workshop:

Overall, the Coastal and Barrier Network scoping workshop was successful. Monitoring questions were drafted by each of the workgroups, and initial lists of indicators were generated for each of those questions. There are advantages to bringing such a large group of experts together during the initial development stages of the Network's monitoring program. Potential cooperators and others learned about the I&M Program, park staff and local experts got to meet and share ideas and problems, and overall, many ideas were generated based on a broad spectrum of expertise.

Advice to other Networks in the initial stages of their program development would be to clearly define their goals for the scoping workshop. If at all possible, provide pre-workshop reading materials in a simplified format. Most people won't read a lot of material ahead of time. Providing a list of objectives that each workgroup should meet during the workshop, as well as a carefully thought out questionnaire so that the information gathered between workgroups is somewhat standardized is extremely helpful when summarizing the results after the meeting. These materials help to keep people focused during the workgroup discussions. Breaking large meetings into small workgroups is highly recommended. Carefully choose one person to lead each workgroup and one person to take notes. Make sure that the leader is someone that has the ability to keep the group focused and the discussion moving. Finally, once the workgroups have met, bring everyone back together to present what they have been discussing. This always generates more ideas and further discussion.

The Vital Signs process is personality driven. We chose to define small workgroups to address specific concerns related to management issues. Highly motivated scientist and park personnel that are able to envision the links between workgroups, projects and funding have been the most successful workgroup leaders. We have been fortunate in having strong relationships with USGS-Patuxent Scientists, the University of Rhode Island, and the North Atlantic Coast Cooperative Ecosystem Studies Unit.

Do not lose sight of your goals. Written reports are necessary to document the process and will be of great help in reconstructing the history of decisions and evaluating progress.

Product Specifications:

It is important to provide product specifications to potential cooperators when requesting proposals. Providing specifications saves time when cooperative and interagency agreements are written. All deliverables and deadlines are written into proposals in a more standardized fashion, and PI's understand what the requirements are when developing budgets. We have written ours in a very simplified and condensed manner so that people may be more likely to take the time to read and follow them.

Database Development:

We have found it incredibly advantageous to work directly with our cooperators in developing databases for inventory projects prior to the start of any fieldwork. This has enabled us to:

- Know exactly what we will be getting ahead of time;
- Let the investigator know what we require;
- Make suggestions on field forms;
- Make suggestions on data collection and methods; and
- Standardize fields and naming conventions across databases so that multiple projects run by different cooperators can be compiled easily into one database if necessary. Reports are standardized, tables, etc…

Teleconferences:

Meetings are difficult to schedule, costly and time consuming; a one-day meeting will require each participant to spend one or two days traveling with associated cost of per-diem, lodging and transportation. For our last Board of Directors meeting we decided to hold a teleconference. This allowed us to invite all board members as well as interested park personnel to participate. Prior to the meeting a PowerPoint presentation was created and sent to all invitees. During the teleconference participants were able to view the presentation on their own workstation. At the end of the conference we asked for feedback on the format and all agreed it was an excellent way to conduct these meetings.